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Occupancy Modeling for an Imperiled Reptile

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Conservation through research and education

Occupancy Modeling for an Imperiled Watersnake

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Introduction

•**Copper-bellied Watersnake**: endangered in IN, MI, & OH, federally listed as threatened

•**Northern Watersnake**: congener, common in CWS range

•**Northern Ribbon Snake**: widespread in CWS range

•**Occupancy modeling**: used to estimate species occupancy, detection probabilities, and patch colonization & extinction rates between seasons

Objective

Use occupancy modeling to compare Ψ, p, γ, and ε among the three species (CWS, NWS, and NRS)

Methods

•Study site: 12 wetland complexes with past CWS observations

•3 visual encounter surveys per complex per year, 2013 & 2014

•Observations of 3 species made into detection histories (detection = 1, nondetection = 0)

•Program PRESENCE used to make models from detection histories, and select models that best fit data

Key to Acronyms and Variables

CWS = Copper-bellied Watersnake = *Nerodia erythrogaster neglecta*
NWS = Northern Watersnake = *N. sipedon sipedon*

NRS = Northern Ribbon Snake = *Thamnophis sauritus septentrionalis*

Ψ = occupancy probability = fraction of habitat patches occupied

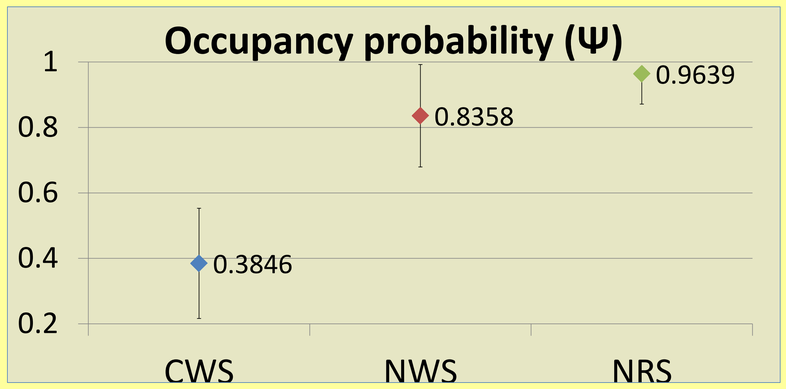
p = detection probability = probability of detecting an organism if the site is actually occupied

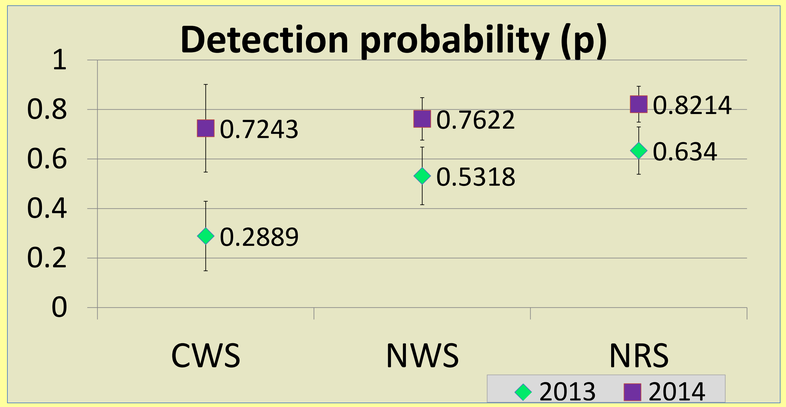
γ = colonization rate = probability of unoccupied site becoming occupied between seasons

ε = extinction rate = probability of occupied site becoming unoccupied between seasons

Results

•Best model for all species: Ψ(.),γ(.),ε(.),p(year)





Discussion

•Differences in p between years due to observer skill or difference in survey timing (1-2 weeks later in 2014)

•2014: p similar for all species; in 2013 CWS much less likely to be detected at occupied sites than other species

•NRS occupies 9.6/10 sites, NWS 8.4/10, CWS only 3.8/10

•Difference in CWS and NWS Ψ may be due to species biology which impacts relative species abundance

Conclusions

•As expected, NRS & NWS had higher Ψ than endangered CWS

•Differences in p between CWS and NWS weren't significantly different, indicating less frequent CWS observations indicate actual rarity, not non-detection

•More analysis needed to deduce cause of yearly variation in p

Future Research

•Models for all species ( ,  , )

•Run 2-species models (CWS & NWS, CWS & prey species)

•Determine effects of habitat on occupancy

•Use ε and γ to predict CWS abundance in future